Model reduction for controller design for infinite-dimensional systems

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Summary

The main aim of this thesis is, as the title suggests, the presentation of results on model reduction for controller design for infinite-dimensional systems. These results are presented for discrete-time systems in Chapter 10 and for continuous-time systems in Section 14.7. They are perfect generalizations of the finite-dimensional results: we obtained existence and uniqueness of minimal LQG-balanced realizations under conditions that are obviously necessary (but it is far from obvious that they are sufficient!) and an error-bound for truncated LQG-balanced realizations. The results are illustrated by a controller design for a beam in Chapter 15.

Along the way we generalized several important theorems and introduced a few promising new concepts. Arguably the most important theorem that we generalize is that on the existence of (strongly) coprime factorizations. The results in Chapter 7 solve this long outstanding problem for which many partial results exist in the literature. The most important new concept resulting from this Ph.D. work is probably that of a (distributional) resolvent linear system. As shown in part II many systems described by partial differential equations fall into this class of systems *and* one can reasonably easily prove theorems for this class of systems. That this new concept brings together well-established concepts such as distribution semigroups, the Cayley transform and nonhomogeneous elliptic boundary value problems strengthens our belief that we have discovered an important new class of systems.